



TWIST1 gene

twist family bHLH transcription factor 1

Normal Function

The *TWIST1* gene provides instructions for making a protein that plays an important role in early development. This protein is a transcription factor, which means that it attaches (binds) to specific regions of DNA and controls the activity of particular genes. Specifically, the TWIST1 protein is part of a large protein family called basic helix-loop-helix (bHLH) transcription factors. Each of these proteins includes a region called the bHLH domain, which determines the protein's 3-dimensional shape and enables it to target particular sequences of DNA. The bHLH family of transcription factors helps regulate the development of many organs and tissues before birth.

During embryonic development, the TWIST1 protein is essential for the formation of cells that give rise to bone, muscle, and other tissues in the head and face. The TWIST1 protein also plays a role in the early development of the limbs. Researchers believe that the TWIST1 protein regulates several genes that are known to be key players in bone formation, including the *FGFR2* and *RUNX2* genes.

Health Conditions Related to Genetic Changes

Saethre-Chotzen syndrome

More than 80 mutations in the *TWIST1* gene have been identified in people with Saethre-Chotzen syndrome. Some of these mutations change single protein building blocks (amino acids) in the TWIST1 protein, while others delete or insert genetic material in the gene. In some cases, this condition is caused by chromosomal abnormalities (translocations or deletions) involving the region of chromosome 7 that contains the *TWIST1* gene.

TWIST1 mutations prevent one copy of the gene in each cell from producing any functional protein. A shortage of functional TWIST1 protein affects the development and maturation of cells in the skull, face, and limbs. These abnormalities underlie the signs and symptoms of Saethre-Chotzen syndrome, although it is unclear exactly how a shortage of the TWIST1 protein causes specific features such as the premature fusion of certain skull bones.

other disorders

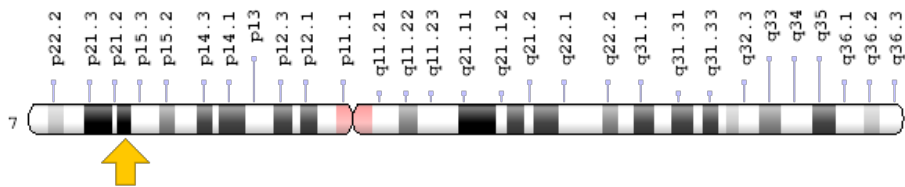
TWIST1 mutations have also been found in several people with isolated craniosynostosis, which is a premature fusion of certain skull bones that occurs without the other signs and symptoms of Saethre-Chotzen syndrome. These

mutations occur near the end of the gene in a region known as the TWIST box domain. This domain enables the TWIST1 protein to bind to and regulate a gene called *RUNX2*, which is a critical regulator of bone formation. Researchers believe that mutations in the TWIST box domain prevent the TWIST1 protein from effectively controlling the activity of the *RUNX2* gene, which disrupts the normal pattern of bone formation in the skull and leads to craniosynostosis.

Chromosomal Location

Cytogenetic Location: 7p21.1, which is the short (p) arm of chromosome 7 at position 21.1

Molecular Location: base pairs 19,113,047 to 19,117,672 on chromosome 7 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- acrocephalosyndactyly 3
- ACS3
- B-HLH DNA binding protein
- CRS1
- H-twist
- SCS
- Transcription factor TWIST
- TWIST
- twist basic helix-loop-helix transcription factor 1
- Twist Homolog
- twist homolog 1 (acrocephalosyndactyly 3; Saethre-Chotzen syndrome) (*Drosophila*)

- twist homolog 1 (Drosophila)
- TWST1_HUMAN

Additional Information & Resources

Educational Resources

- Johns Hopkins Center for Craniofacial Development and Disorders: Disorders of the Skull Vault
http://www.hopkinsmedicine.org/neurology_neurosurgery/centers_clinics/pediatric_neurosurgery/conditions/craniosynostosis/

GeneReviews

- Saethre-Chotzen Syndrome
<https://www.ncbi.nlm.nih.gov/books/NBK1189>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28TWIST1%5BTIAB%5D%29+OR+%28TWIST+AND+craniosynostosis%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

OMIM

- TWIST, DROSOPHILA, HOMOLOG OF, 1
<http://omim.org/entry/601622>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
<http://atlasgeneticsoncology.org/Genes/TWIST1ID44296ch7p21.html>
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=TWIST1%5Bgene%5D>
- HGNC Gene Family: Basic helix-loop-helix proteins
<http://www.genenames.org/cgi-bin/genefamilies/set/420>
- HGNC Gene Symbol Report
http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=12428

- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/7291>
- UniProt
<http://www.uniprot.org/uniprot/Q15672>

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